



Suska GigaFile

User's Manual

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W. Förster

Translation by John Kolak

with support of Matthew Waller

Contact

Inventronik GmbH, Finkenstraße 48, 70199 Stuttgart.

Internet: www.inventronik.de; www.experiment-s.de.

Email: info@inventronik.de

I want to thank all people contributing to this project.

Have Fun.

Wolfgang Förster

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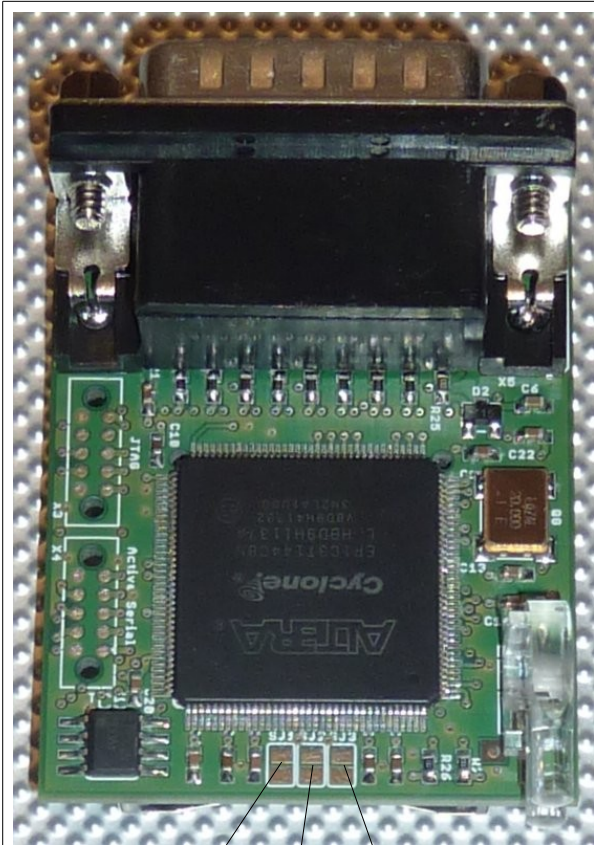
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Introduction

Description

Suska GigaFile is a solid state disk, intended to work on Atari ACSI- or SCSI interfaces. The physical memory SD cards are foreseen. In this way, the GigaFile is widely configurable using SDSC (cards with small capacity up to 2GiB), SDHC (cards with high capacity from 2GiB to 32 GiB) or SDXC (cards with capacities greater than or equal 32GiB). So this product should meet any individual requirements.

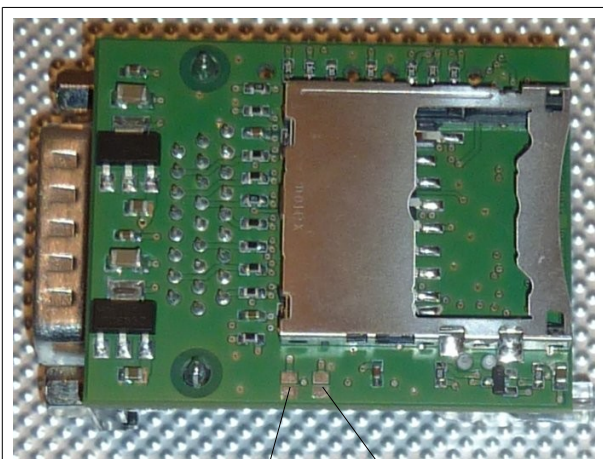
The focus of development of the GigaFile was the compatibility to both bus protocols, the Atari Computer System Interface ACSI and the Small Computer System Interface SCSI. The Configuration of the desired bus protocol is done via the connecting cable or adapter. The electronic circuitry is placed on a double sided mounted printed circuit board which has an area of 50x40mm². The boxed GigaFile measures 60x55x30mm³. **Therefore it has a volume which is a factor of 80 times smaller** in comparison to Atari's 20MiB hard disk drive SH205! Beside the 26 position HD-D-SUB connector and the connector for the SD card, the GigaFile is equipped with two LEDs indicating the operation status.



SJ1 - SJ2 - SJ3

Figure 1: GigaFile PCB Top View

The development of the GigaFile went hand in hand using the current version of the HDDRIVER hard disk driver from Uwe Seimet. Optimizations for this driver are implemented in the digital logic, so it is recommended to use a recent version of HDDRIVER (8.45+) with the GigaFile. The functionality and the technical data described in this manual refer to the **GigaFile Slim R.01**. This version number is indicated while booting with HDDRIVER.



TDR2 - TDR1

Figure 2: GigaFile PCB Bottom View

Compatibility Issues concerning SD Cards

All SDSC, SDHC, SDXC cards, which can handle blocks of 512 Byte size, are suited for the operation in the GigaFile. Some SDSC cards with a capacity of more than 1GiB may not work properly. This behaviour is described in detail in the section Tricks and Limits. To verify if a card is suitable or not, it can for example be inserted into a card reader connected to a Windows PC. Open the formatting dialogue. There is a setting, 'Cluster Size'. In conjunction with the FAT file system, you should see cluster sizes of 8192 Bytes or less. In this case the SD card is usable in the GigaFile.

One Word about the Transmission Data Rate

The GigaFile is based on block orientated mass storage devices, SD cards. These cards are read and written block wise, so once it starts to read or write a block, there is no way to interrupt at any time until the block is completely transferred. If, for example, 10 blocks are written, the connected host computer must deliver 5120 bytes without any interruption. Although the GigaFile theoretically may read and write 2MiB per second, it is adjusted in such a way that the direct memory address (DMA) channels of the connected computers (Atari, Suska) can keep up with the GigaFile transmission data rate. Thus the following data transfer rates results:

Atari ST read	Atari ST write	Suska-III-C read	Suska-III-C write	TT read	TT write
600kByte/s	500kByte/s	1200kByte/s	1000kByte/s	1800kByte/s	1600kByte/s

Table 1: Achievable Data Transfer Rates

To meet the correct adjustment, the TDR is measured during the first access to the GigaFile. In this way it is ensured that the DMA channels are not operated beyond the maximum transmission speed. However it may occur that in case of 'exotic' workings of DMA logic that the measurement fails, resulting in errors during read or write operations. Therefore it is recommended to test the GigaFile carefully before using it in 'daily business'. If the measurement of the TDR is not working correctly, there is a fall-back solution using the two configuration bridges TDR2 and TDR1 located at the bottom side of the PCB (see 2) for a manual configuration of the TDR. The following table shows how the settings affect the TDR. If either of the bridges is closed, the automatic measurement of the TDR is disabled.

TDR2	TDR1	TDR2	TDR1	TDR2	TDR1
Closed	Closed	Closed	Open	Open	Closed
High Transfer Rate		Medium Transfer Rate		Low Transfer Rate	

Features

The operation of the GigaFile in principle is possible at any SCSI or ACSI bus with any hard disk driver. The ACSI bus has limitations concerning the maximum size of the inserted SD cards; the maximum usable size is limited to 1GiB when SDSC, SDHC or SDXC cards are used in conjunction with any hard disk drivers. To remove this limitation, the GigaFile can operate in conjunction with modern hard disk driver (HDDRIVER) SCSI-II compatible commands. Thus it is

possible to use SD cards with higher capacities than 1GiB at full capacity. There are also limitations of the maximum size of a partition and the maximum number of partitions of the operating systems used (TOS, MINT etc.). Again, the detailed information in this documentation is based on the use of a current version of the hard disk driver HDDRIVER from Uwe Seimet (version 8.45 or above). The reason for this choice is on the one hand, the fact that HDDRIVER is the only one which has been in active development for many years (from 1989 to the present), and on the other hand the development of the GigaFile has taken place by intensive use and testing with HDDRIVER. The GigaFile detects the type of the inserted SD card automatically. In principle it is possible to remove the SD card during the operation at the ACSI port (for example to exchange data with a notebook) and reinsert it for further use without a restart of the Atari computer.

GigaFile can operate all types of SD cards. There are no limitations during the operation if HDDRIVER is used. SDSC cards are configured during the start up sequence of the GigaFile to handle blocks of 512 bytes. SDHC and SDXC cards also work with a block size of 512 bytes. It may occur that some SD cards do not work properly. Reasons, therefore, may be incompatible supply voltage ranges or cards with block sizes different from 512 bytes. The supply voltage is 5V and is connected beside the ACSI and SCSI bus signals to the 26 position HD-D-Sub header. To connect the GigaFile to the Atari ST or to any SCSI interfaces, use the respective cable adapters or one of the PCB adapters which are separately available at Inventronik GmbH. To connect the GigaFile to the Suska-III-C board, use a 1:1 wired 26 pos. HD-D-Sub cable (male - female) or connect it directly, that is without cable, to the ACSI header of the Suska-III-C. The GigaFile is inactive if there is no SD card inserted.

Operation of the GigaFile

LED-Signalling

Once connected to the host computer and an SD card is inserted, the GigaFile is ready for preparation or use without any further action required. Both LEDs (green and red) will indicate information about the operating condition. Each of the two LEDs indicate two operating conditions as follows:

The green LED starts flashing for about 5s after a system start or after the SD card was removed and is inserted again. The flash frequency depends on the type of the inserted SD card. If an SDSC card is detected which relies on the SD card specification 1.x, the frequency is about 1Hz. 2 Hz results from SDSC cards relying on the SD card specification 2.x. SDHC and SDXC cards cause a frequency of about 4Hz. After five seconds the LED is switched on permanently, but with reduced intensity, indicating correct operating condition of the GigaFile.

The red LED is switched on with reduced intensity after a system start up and if the SD card is inserted. The same condition occurs if the SD card is removed and inserted again. This condition means that the Card is operating with a reduced transmission data rate, which is important for the TOS boot option and also to operate the GigaFile correctly on systems with slow direct memory access (DMA) channels. Access to the SD card is indicated with light pulses of full intensity. Once HDDRIVER become active, the transmission data rate to or from the GigaFile is measured and correct parameters are adjusted. If the connected computer is capable of handling high data rates, the weak red LED is switched off. This happens for example when the GigaFile is connected to the Suska hardware, to TT computers or overclocked STs. If the connected computer cannot perform high data transmission rates, the red LED indicates this with a weak red.

Inserting and Operation of SD Cards

SD cards in standard form factor are inserted upside down (contacts on top) into the GigaFile SD card slot. Removing and inserting works with a push-pull mechanism. As soon as an SD card is removed and another one is inserted, it will be initialized immediately and the card parameters are switched transparently to the hard disk driver.

The GigaFile reads the *Write Protection Sliders* of SD cards, so the respective warnings will be shown if there is an attempt to write to a protected card.

Attention! If the cards are removed during read or write access, a complete data loss cannot be ruled out. If cards are set up with HDDRIVER and the option, TOS/WIN compatible partitions, it is possible to exchange data from the GigaFile to any personal computer without restarting the host of the GigaFile. Do not remove cards and insert different cards. In this way there is also the possibility of a complete data loss on the inserted card.

If the user is not completely aware of the behaviour of the operating system in connection with the hard disk driver, it is strongly recommended to change the cards after the host has been shut down.

Power Supply

There are several possibilities to power the GigaFile. This mainly depends on the system to which it is connected. In principle there are the following three options:

1. Connected Suska-III-C
2. Connected to a 19 pos. ACSI port.
3. As SCSI device, for example, in conjunction with a 25 pos. D-SUB adapter.

Configuration of the ACSI/SCSI Identification Number

On the top of the printed circuit board of the GigaFile there are three configuration bridges (solder types, see 1). The respective ID number is selected, shortening these bridges partially or entirely. The following table lists all possible ID numbers and the respective settings of the bridges. The default factory setting of the GigaFile is ID 0.

SJ1	SJ2	SJ3	ID	SJ1	SJ2	SJ3	ID
Open	Open	Open	0	Closed	Open	Open	4
Open	Open	Closed	1	Closed	Open	Closed	5
Open	Closed	Open	2	Closed	Closed	Open	6
Open	Closed	Closed	3	Closed	Closed	Closed	7

Table 2: ID Configuration

Bus Termination in the GigaFile's SCSI Mode

A correct bus termination is a prerequisite for a stable and accurate operation. The GigaFile is not equipped with an internal bus termination circuitry, so there is a need for an external termination. This is possible with a single ended termination, for example, from the host's side. This is possible when the cable is short. Another way is to use external bus terminators. Please be aware that there may be only two terminators located on each end of the SCSI bus, even if more than two devices are connected. Deselect all internal bus terminations which are not required to meet this arrangement.

Tricks and Limits

This chapter describes some known issues concerning the operation of the GigaFile in conjunction with the connected hardware and the hard disk driver used. The contexts are often not trivial and sometimes it seems that the SD cards or the GigaFile won't work correctly. The following things were found during intensive testing.

1. SDSC cards with block sizes greater 512Byte: Some SD cards seem not to handle blocks of 512 bytes. This does not conform to the SD card specification. Among these are, for example, 2GB SDSC cards. The SDSC specification reserves 12 Bit addresses and a maximum multiplication factor of 512. So there are a maximum of $2^{12} * 512 = 2.097.152$ blocks. To create 2GB cards, the blocks size is not 512MB but 1024 MB. Those cards are not possible to operate in the GigaFile. Use SDHC cards instead.
2. During the boot process from the GigaFile, the transmission data rate of the connected computer will be measured as described above. This is to allow the TOS operating system to boot from the card correctly. The reason for this feature is a race condition in TOS. Booting from hard drives is not possible if the data is read too slow or too fast. Although the GigaFile is developed carefully and with intensive testing to meet this requirement, there is no guarantee that all the different hardware will boot from SD card in every case. A workaround is to use HDDRIVER booted from a floppy disk drive or from another hard disk connected to the IDE port, which can be found in STEs, Stacys or STBooks.
3. The GigaFile supports the HDDRIVER option, *Fast ACSI*. If HDDRIVER is used with this setting, the read and write transmission data rate is about 15% higher.
4. If big SD cards are connected and partitioned with HDDRIVER, there is a need for the option, ICD compatibility. Otherwise partitions which are located beyond the 1GB limit are not detected and there is no way to access them. In this case HDDRIVER gives a warning during the boot process, "Error while reading the partition data".
5. Even if more than one partition is installed with TOS/Win compatibility during partitioning with HDDRIVER, the Windows operating system detects only the first one. This is not an error, but more a poor feature of Windows.
6. During Partitioning or Formatting the SD cards, there are unwanted warnings or errors: in this case have a look on the write protection slider of the inserted SD card. Perhaps it is (by accident) switched to write protection.

Annex

Pin Out of the 26 pos. ACSI/SCSI Connector

Pin No.	Function
1	Data Bus Bit D7
2	GND
3	Data Bus Bit D6
4	SCSI_ATNn
5	Data Bus Bit D5
6	GND
7	Data Bus Bit D4
8	GND
9	Data Bus Bit D3
10	SCSI_DPn
11	Data Bus Bit D2
12	GND
13	Data Bus Bit D1
14	GND
15	Data Bus Bit D0
16	GND
17	ACSI_SCStn
18	SCSI_IOn
19	VCC
20	ACKn
21	REQn
22	CSn_DCn
23	RSTn
24	CA1_MSGn
25	INTn_BUSYn
26	CRWn_SELn

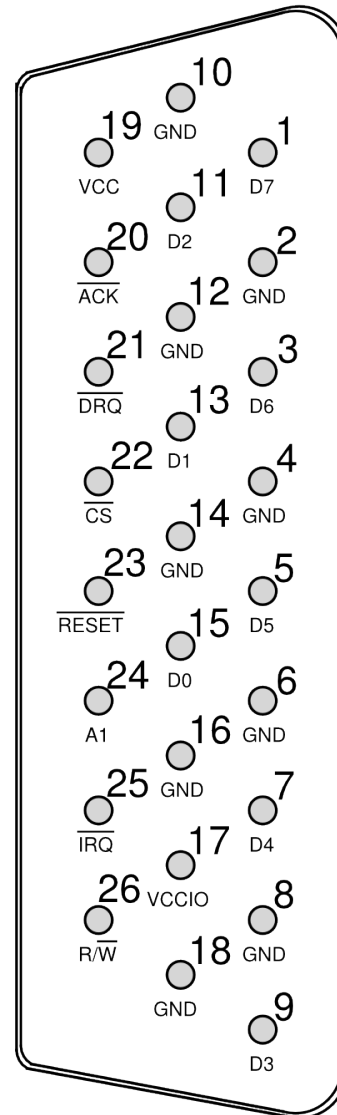


Figure 3: Layout of the 26 position HD-D-SUB

Table 3: Pin Out of the 26 pos. HD-D-SUB

Remark: The pin numbers are normally marked on the D-SUB connectors. If not, take care of the fact that the numbering is ascending in comparison to other headers, and not alternating, but row-wise.

Pin Out of a 19 position D-SUB ACSI Connector

Pin Nr.	Function
1	DB0
2	DB1
3	DB2
4	DB3
5	DB4
6	DB5
7	DB6
8	DB7
9	/CS
10	/INT
11	GND
12	/RESET
13	GND
14	/ACK
15	GND
16	A1
17	GND
18	R/W
19	/DRQ

Table 4: ACSI Pin Out of a 19 pos. D-SUB

Pin Out of a 25 position D-SUB SCSI Connector

Pin No.	Function
1	/REQ
2	/MSG
3	I/O
4	/RST
5	/ACK
6	BSY
7	GND
8	DB0
9	GND
10	DB3
11	DB5
12	DB6
13	DB7
14	GND
15	C/D
16	GND
17	/ATN
18	GND
19	/SEL
20	PARITY
21	DB1
22	DB2
23	DB4
24	GND
25	TMPWR

Table 5: SCSI Pin Out of a 25 pos. D-SUB

Cable Assembly ACSI-GigaFile

GigaFile 26 pos.	ACSI 19 pos.
1	8
2	11
3	7
4	13
5	6
6	15
7	5
8	17
9	4
10	n.c.
11	3
12	n.c.
13	2
14	n.c.
15	1
16	GND (0V)
17	n.c.
18	n.c.
19	VCC (+5V)
20	14
21	19
22	9
23	12
24	16
25	10
26	18

Table 6: Cable Assembly GigaFile-ACSI Interface

Cable Assembly Suska-III-C-GigaFile

The GigaFile is best fitted to Suska-III-C. It is pluggable directly to the Suska-III-C ACSI connector without the use of a cable. If a cable should be used, it is a 1:1 wired 26 pos. HD-D-SUB cable assembly with one end having a female connector, and the other end male.

Cable Assembly SCSI-GigaFile

GigaFile 26 pos.	SCSI 25 pos.
1	13
2	9
3	12
4	n.c.
5	11
6	n.c.
7	23
8	16
9	10
10	20
11	22
12	14
13	21
14	18
15	8
16	24
17	4
18	3
19	25
20	5
21	1
22	15
23	4
24	2
25	6
26	19

Table 7: Cable Assembly GigaFile-SCSI Interface

GigaFile connected to the internal Bus of STE and Stacy

26pol.HD-Sub-D Pin 19	VCC +5V	30	29	GND	26pol.HD-Sub-D Pins 2, 4, 6, 8, 12, 14, 16
	VCC +5V	28	27	GND	
	VCC +5V	26	25	GND	
	frei	24	23	INTn_BUSYn	26pol.HD-Sub-D Pin 25
26pol.HD-Sub-D Pin 21	REQn	22	21	CRWn_Seln	26pol.HD-Sub-D Pin 26
26pol.HD-Sub-D Pin 24	CA1_MSGn	20	19	CSn_DCn	26pol.HD-Sub-D Pin 22
26pol.HD-Sub-D Pin 20	ACKn	18	17	RSTn	26pol.HD-Sub-D Pin 23
Datenbus-Signale von (MegaSTE U403 (74LS245)) kommend	Data Bus Bit D7 >	16	15	Data Bus Bit D7 >	Signalweiterleitung zur externen 19.pol ACSII-Buchse. Bei Fehlen des internen Host-Adapters Pins entsprechend brücken, damit ext.ACSII funktioniert! (2-1, 4-3, 6-5, 8-7, 10-9, 12-11, 14-13, 16-15)
	Data Bus Bit D6 >	14	13	Data Bus Bit D6 >	
	Data Bus Bit D5 >	12	11	Data Bus Bit D5 >	
	Data Bus Bit D4 >	10	9	Data Bus Bit D4 >	
	Data Bus Bit D3 >	8	7	Data Bus Bit D3 >	
	Data Bus Bit D2 >	6	5	Data Bus Bit D2 >	
	Data Bus Bit D1 >	4	3	Data Bus Bit D1 >	
	Data Bus Bit D0 >	2	1	Data Bus Bit D0 >	

Mit freundlicher Unterstützung von U. Stapelkamp.

Table 8: MegaSTE J402 (and Stacy, J11?) 30pos. Header to GigaFile HD-D-Sub

Notes